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ABSTRACT

This student module on structural egress and emergency procedures is one of 50 modules concerned with job safety and health. This module gives an insight into the kind of structural conditions that must exist for emergency evacuation to be swift and efficient. Following the introduction, eight objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., Describe the features of a good employee alarm system). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

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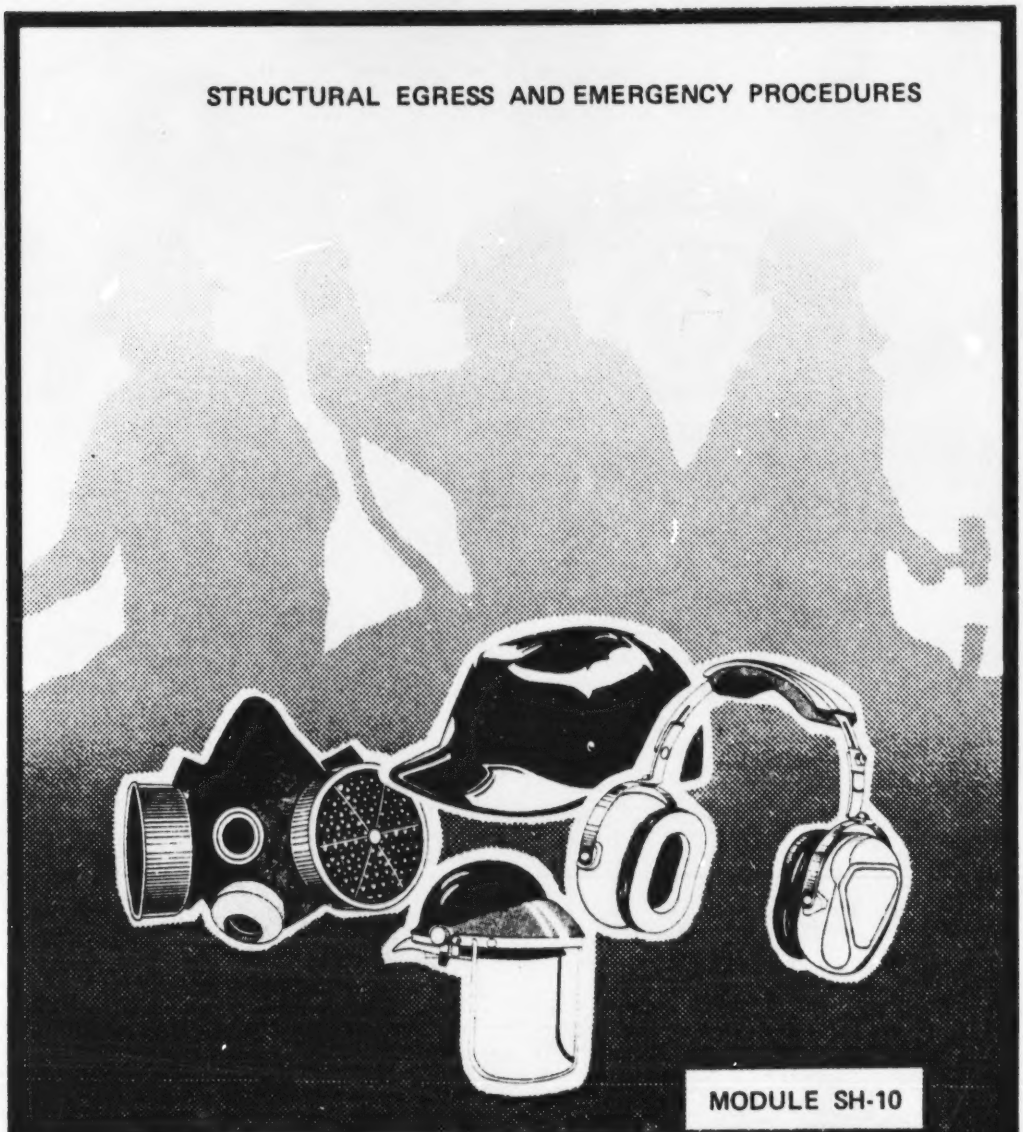
SAFETY AND HEALTH

STRUCTURAL EGRESS AND EMERGENCY PROCEDURES



MODULE SH-10

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INTRODUCTION

If you work in a building, you should know how to get out of it quickly. Emergency plans may exist for your workplace, but your life may depend upon your understanding of and familiarity with the plans. Do you know what to do and where to go if there is a fire in your building?

Every day fires and other disasters extract a huge toll in human life and property damage. This toll can be reduced! Fire resistive construction, automatic sprinkler systems, measures for restricting the spread of fire, alarm systems, and most important, the provision of adequate exits, will save lives. Planning and practicing emergency actions can also reduce the loss of lives in fires, chemical accidents, and natural disasters.

Provisions for fire protective measures and means of egress are contained in building codes adopted by local governmental jurisdictions. The fire safety provisions in these codes are based on the standards published by the National Fire Protection Association (NFPA). This association is a nationally recognized association of fire prevention experts who represent every activity and organization interested in this subject.

This module gives a brief insight into the kind of structural conditions that must exist for emergency evacuation to be swift and efficient. The emergency action plan that employees can expect their employers to develop and make known to them is described in detail. The role of good housekeeping in emergency preparedness is discussed, and the needs of handicapped workers during an emergency are outlined. Finally, a list of "do's and don't's" in emergencies is provided.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Define the term "means of egress," and identify the three parts of means of egress. (Page 3)
2. Discuss the basic requirements applicable to all means of egress. (Page 4)
3. List good housekeeping practices that relate to means of egress and emergency procedures. (Page 6)

4. List the basic requirements for an emergency action plan. (Page 8)
5. Describe the features of a good employee alarm system. (Page 10)
6. State at least four factors that should be considered in evacuation planning and training. (Page 11)
7. State three ways in which the needs of handicapped persons should be considered in the development of emergency action plans. (Page 12)
8. List seven "do's and don't's" that relate to fire and emergency situations. (Page 14)

OBJECTIVE 1: Define the term "means of egress," and identify the three parts of means of egress.

"Means of egress" is a term that refers to the system of passages or paths that people take to get out of a building. Means of egress may include rooms, doorways, lobbies, hallways, balconies, ramps, stairways, escalators, courtyards, or rooftops. Locked storerooms or dead-end passageways would not be considered means of egress.

There are three parts to any means of egress, and it may be helpful to think of these three parts if you are involved in working out evacuation routes (routes for leaving the building) or trying to understand an employee evacuation plan. These three parts are listed here:

- The "exit access" is the path taken to the entrance to an exit, such as the hallway that leads to an enclosed stairway (stairwell).
- The second part of the means of egress is called the "exit." This might be a stairway that leads to a door out of the building, or a hallway that has an exit door at the end of it.
- The "exit discharge" is whatever leads directly to the open air, such as the swinging doors, the fire doors, the garage exit, or the door to the loading dock.

Regulations concerning "means of egress" are given in the Life Safety Code Handbook that is published by the National Fire Protection Association. Local building codes are based partly on the standards set down in this book. These codes regulate the number and kind of exits per building. If you are concerned that the building you work in is poorly designed for safe evacuation, the Life Safety Code Handbook is a good source of information about what kind of structure is considered safe.

Workers may be able to upgrade the safety of their building by being aware of temporary barriers to safe evacuation. These barriers may result from poor housekeeping practices, loading and unloading materials, remodeling or other conditions that block the means of egress. All workers on the job need to be aware of any activity or material that blocks exits, hallways, stairs, or rooms leading to exits. Workers should report to supervisors any situation where exits are not usable.

ACTIVITY 1:*

1. Give a definition for means of egress: _____

   _____

2. Give an example of each of the following parts of means of egress:
   a. Exit access – _____
   b. Exit – _____
   c. Exit discharge – _____

OBJECTIVE 2: Discuss the basic requirements applicable to all means of egress.

When a building is being designed or remodeled, four things are considered in determining the means of egress:

- The methods and materials of construction.
- The number of people who will use the building.
- The activities that will be carried out in the building.
- The fire loading. Fire loading is a term given to the expected maximum amount of combustible materials stored or used in the building.

The basic requirement concerning means of egress is that design for exits and other life safety measures should include more than one safeguard. Alternative routes of travel for use in case one exit is blocked by fire are required for all buildings. Sprinkler systems or other fire protection systems need to be supplemented by another form of protection, in case one system fails.

Exits must be fire-resistive for as long as they are expected to be used during evacuation. Enclosed stairways and fireproof smoke towers are constructed of materials that can resist fire for a period of time so that people using these exits will be protected during evacuation. The term fire-resistive is more accurate than fireproof because no material is completely capable of withstanding fire, without failure.

*Answers to Activities appear on page 15.

Every exit needs to be clearly visible. The route to the exit should be marked if there is any chance of confusion. Any doorway that is not an exit should be marked with a suitable label (such as "office," "closet," or "basement") to prevent confusion. When the employer's emergency evacuation plan is developed, workplace floor plans or maps should be used to show emergency escape routes. Color coding of the actual passageways may be used to show the way to safety. Knowing that there is a safe way out is an important factor in preventing panic.

All parts of the means of egress should be well lighted. A fireproof stairway leading to an exit will not provide a quick escape unless people can see where they are going.

Exit signs, including signs that direct people to the exit, should be clearly visible. Emergency lighting should be located near exit signs so that if a power outage (shortage) should occur, people will still be able to find the exits.

Doors that lead to exits and exit doors should swing open in the direction of exit travel. Exit doors should not be locked. In situations where locked exits are necessary (prisons or locked mental wards), members of the staff must always be available to unlock the doors and help residents to safety in case of an emergency. Often building security personnel will lock fire exits. Some arrangement should be made so that both security and fire safety can be maintained.

Exit doors should be checked regularly to see that they open easily and close quickly and completely. Other parts of the escape route, such as ramps, fire escape stairs, hand rails, and stair treads should be kept in usable condition.

ACTIVITY 2:

Mark each of these statements true or false.

_____ 1. At least one exit must be provided for safe evacuation.

_____ 2. Exits should be adequately lit and marked with signs.

_____ 3. Fire exits should be locked until the time of use.

_____ 4. Doorways that do not lead to exits should be marked "not an exit" or with appropriate labels.

5. Name four things that have to be considered in determining safe means of egress.

a. _____

b. _____

c. _____

d. _____

OBJECTIVE 3: List good housekeeping practices that relate to means of egress and emergency procedures.

Good housekeeping is important in maintaining a clear means of egress. Hallways or stairways should not be used for storage, temporary loading and unloading, bicycle parking, or temporary disposal of garbage. Firm rules should be established and explained to all employees to prevent any blocking of means of egress. (See Figure 1.) Employees should report infractions of these rules to the supervisors.

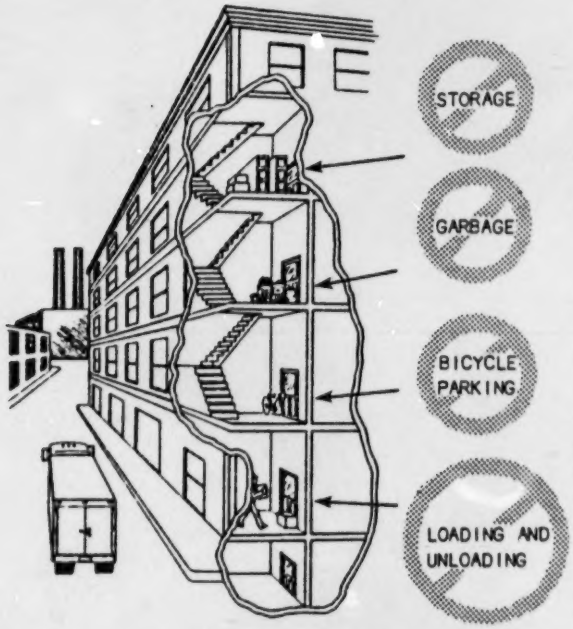

Figure 1. Examples of blocking of means of egress.

The building manager or the custodian is often in the best position to correct the improper use of the means of egress. Maintenance staff can assume a key role in emergency preparedness by checking and reporting any blocking of the means of egress. Any part of the means of egress that is in such poor repair that is cannot be used should also be reported. Doors and door hardware ramps, stairways, (including condition of treads and railings), and lighting should be reported if they do not work properly or are inadequate for emergency use.

Fire protection systems also need to be checked regularly.

It is generally recognized that automatic sprinkler systems are the most effective means of controlling fires in buildings. Automatic sprinklers distribute enough water on a fire to put it out entirely or to limit its spread if it is a type of fire that cannot be extinguished by water. When automatic sprinklers are properly installed and maintained, they provide effective safeguards against loss of life from fire. Automatic sprinklers fail only in rare instances. These failures are usually due to lack of water. One study in the Fire Protection Handbook showed that in almost 30% of cases where sprinklers did not work to extinguish a fire, the systems had been shut off. In at least another 30% of the cases, unsatisfactory sprinkler performance was related to poor maintenance of some kind.

Water supply test pipes and pressure gages to test each sprinkler system are supplied when the system is installed. Test connections are arranged so as to permit a test with the system's main valve wide open. An approved gage is installed to show the pressure at or near the test connection. These tests are made without the system discharging water that would damage the building's contents. The sprinkler system should be inspected, cleaned and tested at least each spring as soon as danger of freezing has passed, and each fall at the approach of freezing weather. In those places in the United States not subject to freezing weather, the sprinkler system should be inspected, cleaned, and tested on an established date at least twice each year.

Sprinkler systems can only be effective if they operate when called upon. Diligent and thorough maintenance of the system is necessary to ensure that it will work on demand. Although sprinkler systems are sturdy and durable, they may deteriorate through neglect, from being left unprotected when the building is painted, or from being exposed to corrosive conditions. Deterioration, freezing or mechanical damage to the system may cause water leakage. For these reasons, the building manager, or other responsible person, should ensure the adoption of a carefully developed procedure of inspection by a qualified employee. In addition to this inspection, sprinkler systems may be periodically inspected by the insurance carrier, by local fire departments, by a service offered by the sprinkler manufacturer, or through a contract with a central station supervisory service. The maximum life of sprinkler heads is 50 years and heads that reach age should be changed.

ACTIVITY 3:

1. Name four ways in which means of egress can be blocked if good housekeeping practices are not enforced.
   a. _____
   b. _____
   c. _____
   d. _____
2. Name four reasons (related to poor maintenance and inspection) for sprinkler systems failure.
   a. _____
   b. _____
   c. _____
   d. _____

OBJECTIVE 4: List the basic requirements for an emergency action plan.

Every business and industry must have an emergency action plan in case of a fire or similar crisis. Other situations that might require emergency action are toxic (poisonous) chemical releases or spills, hurricanes, tornadoes, blizzards, or floods. Employers have three choices for such a plan; in an emergency, they may —

- Have all workers evacuate the building or plant, and call authorities to perform any necessary disaster control.
- Train a small group of workers to carry out firefighting or other emergency duties while the rest of the workers evacuate.
- Train all workers for firefighting and emergency action.

Whatever plan your employer has developed, it must be in writing if there are more than ten employees in the workplace. This plan should be reviewed with workers at least once a year. (See Figure 2.) If some or all of the employees are to take an active part in firefighting or emergency actions, then more frequent training will be needed to make sure everyone knows what his or her emergency duties are. If the plan is changed at any time during the year, the employer should immediately inform employees.

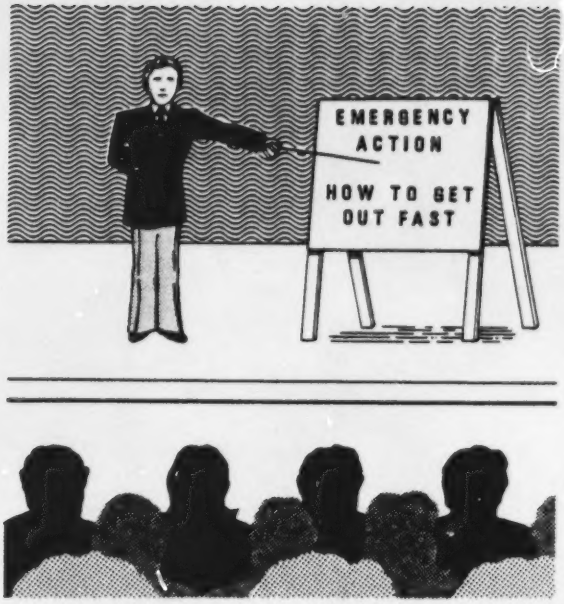

Figure 2. The emergency action plan should be reviewed with employees.

It has been found that people are much more orderly and rapid in their actions during an emergency when they have been trained in procedures to follow. Fire drills can instill the knowledge of what to do in a fire or other disaster. The need for fire drills and other training will depend a great deal on the workplace. Some industries have a higher risk of fire than others; therefore, more emergency action drills will be needed.

Every emergency plan should include the following:

- Planned escape routes and actions.
- A way to account for all employees once evacuation has taken place.
- Assigned rescue and medical duties if there are employees trained for and able to carry out those duties.
- The way the fire is to be reported to other employees and to the authorities.
- The names of key employees in the plan -- those who can give other people information about it.

ACTIVITY 4:

Put a check (✓) beside each item that must be part of an emergency action plan.

_____ 1. The way the fire is reported to other employees.

_____ 2. Assigned rescue and medical duties.

_____ 3. Firefighting training.

_____ 4. A plan to account for all employees once evacuation has taken place.

_____ 5. Planned escape routes and actions.

_____ 6. The way the fire is reported to the authorities.

_____ 7. The plan must be written if the employer has more than ten employees.

_____ 8. The names of those employees who have information about the plan and who can give information to others.

_____ 9. A "fire leader" to tell everyone what to do in case of fire.

OBJECTIVE 5: Describe the features of a good employee alarm system.

The alarm used to warn workers of fire or other emergencies should be a signal known to everyone on the job. It should be easily seen or heard above surrounding noise or light levels. Workers who cannot perceive light or sound systems because they are handicapped or because of the kind of job they are doing, should be alerted by another worker in a "buddy system."

The purpose of the alarm system is to warn workers to leave the building or take emergency action. Some alarm systems also alert the fire department or other emergency help automatically. If they do not, then employees need to be told the best way to call for outside help. Emergency numbers should be posted beside telephones. If there are ten or fewer employees in a workplace, then voice communication may serve to sound the alarm.

Proper maintenance of alarm systems is most important. Responsibility should be assigned, in writing, to a competent person who will make tests at proper intervals and have charge of all alterations to the system.

ACTIVITY 5:

Mark each of these statements true or false.

_____ 1. A good alarm system should be a signal known to everyone.

_____ 2. A good alarm system can alert workers through light or sound, but it must be electronic.

_____ 3. All alarm systems automatically notify the fire department or other emergency help.

_____ 4. A "buddy system" may be required to alert handicapped workers.

OBJECTIVE 6: State at least four factors that should be considered in evacuation planning and training.

At the time of an emergency, all employees should know what kind of evacuation is necessary and what their role is in carrying out the plan. All evacuation routes and emergency duties should be worked out ahead of time. Each employee should be informed of these procedures and when necessary, trained in performing them. If you are in a building or plant where a fire or other emergency occurs, follow the practiced plan rather than trying to be a hero or heroine and "save the plant." Where everyone follows the planned steps, there is less chance of confusion and accidents.

In some very serious emergencies, every worker in the building may need to leave. For example, if a ventilation system for a toxic gas breaks down, and the gas is being released into the atmosphere of the building, all employees would probably have to leave. In other emergencies, only part of the workplace may need to evacuate while others stay behind to carry out needed operations. The employer should list in detail the procedures to be taken by those workers who have been chosen to stay behind to care for essential plant operations. All procedures, including their evacuation, should be listed. Essential plant operations might include the monitoring of plant power supplies such as electricity or natural gas, water supplies, and other basic services that cannot be shut down for every emergency alarm. Some chemical or manufacturing processes may need to be shut down in steps or stages; in these cases, certain employees must stay behind to make sure that shut-down procedures are carried out safely.

The employer should also develop and explain in detail what rescue and medical first aid duties are to be done and by which employees.

Sometimes the entire building or plant may not have to be evacuated; in these cases, a special alarm would sound for employees in the endangered area. They would then proceed to a safe area. The refuge area (safe area) may even be within the building, but separated by fire walls. If the refuge area is outside in a field, parking lot, or street, it should be large enough to hold all the employees who will need to use it. Workers should be trained to move away from exit doors once they leave the building, and to stand far enough

away from the building to leave room for firefighters or other emergency rescue teams.

In a large plant or business, employers usually appoint "evacuation wardens" to provide guidance and instruction to other workers during an emergency. These evacuation wardens should be trained in the complete layout of the workplace so that if the need for alternate escape routes should arise, they will know how to lead others to safety. Wardens, as well as other employees, should be made especially aware of handicapped workers who may need extra help in getting out. Wardens should be in charge of checking rooms to see that no one is left behind during the evacuation of a particular area. Usually there should be at least one warden for every twenty workers.

The wardens will also be responsible for accounting for all employees once they are evacuated to safe areas.

When developing evacuation plans for buildings with more than one business, employers would be wise to coordinate with one another. A single plan for everyone in the building or at least for everyone on the same floor should be drawn up co-operatively.

ACTIVITY 6:

List four things that should be considered in evacuation planning.

_____

_____

_____

_____

OBJECTIVE 7: State three ways in which the needs of handicapped persons should be considered in the development of emergency action plans.

Handicapped or disabled workers are taking their place in the nation's workforce in increasing numbers. Therefore, it is very important that handicapped workers be included in emergency action plans.

Who are the handicapped? A handicap (disability) may be any physical or mental condition that places some limitations on ordinary living and working activities. Physical disabilities include such things as paralysis, loss of limbs, impairment to one of the senses (such as sight or hearing), or loss of some other bodily function. Mental disabilities include mental illness and mental retardation. Alcoholism, drug abuse, and behavior or personality problems are also handicaps.

Special thought should be given to handicapped workers when emergency action plans are being developed. Alarm systems must be designed so that handicapped workers can perceive them. A voice alarm or bell alarm may need to be supplemented with flashing lights for deaf workers, for example. There are new tactile alarm systems that appeal to a person's sense of touch, and these may supplement other alarm systems, too. A "buddy system" can aid those who have difficulty perceiving alarms or understanding instructions, but a trained "buddy" may not always be present, and some backup system should be provided. Handicapped persons should also have some means of reporting a fire or emergency quickly.

Emergency evacuation of the handicapped should include an alternate escape route. A special key-operated elevator can be used by a fire warden or rescue workers to take handicapped people to safety. These elevators have to be designed to bypass floors involved in a fire.

Often, disabled workers are excused from taking part in emergency evacuation drills because of possible inconvenience, anxiety, or threat of injury. However, practicing evacuation procedures is the very thing that could ensure the safety of handicapped (and nonhandicapped) workers. People who have practiced emergency action are less likely to panic and are able to deal with the unexpected more easily than those who are simply told what to do during the emergency.

ACTIVITY 7:

1. Name two types of alarm signals that can be used to warn people with a hearing disability of an emergency.
   a. _____
   b. _____

2. Fill in the blank:

   An alternative escape route for physically handicapped people might include _____

3. Underline the appropriate word(s):

   a. Disabled workers should/should not be involved in emergency action drills because of the difficulties involved.

OBJECTIVE 8: List seven "do's and don't's" that relate to fire and emergency situations.

The emergency action plan will vary with each company. Most plans will call for employees to "sound the alarm" first, and then to either evacuate or to begin emergency duties. Generally speaking, the sooner the fire is reported to the proper authorities, the better it can be fought. For a fire or other emergency situation, a few guidelines are helpful:

- Know your exits, including an alternate exit, in case the escape route you have in mind is blocked.
- Act, do not investigate. Precious time is lost when people try to see how far the fire has traveled, and so on.
- If the fire is in your section, get out and close the door.
- If the fire is not in your immediate area, feel all doors before opening them. If they are warm, do not open them. The smoke or the flames that could be on the other side of the door could easily overpower you and prevent your escape.
- If you are exposed to smoke, crawl low to the floor to avoid breathing it as much as possible.
- Do not use elevators unless they are key-operated by a fire warden or other responsible person. Many elevators have heat-sensitive buttons and may take you to the fire instead of away from it.
- Follow the emergency action plan that you were given by your employer

ACTIVITY 8:

Mark each of these statements true or false.

_____ 1. Try to see how far the fire has traveled.

_____ 2. If the fire is not in your immediate area, feel all doors before opening them.

_____ 3. If doors are warm, do not open them.

_____ 4. If you are exposed to smoke, stand up and run.

_____ 5. Elevators sometimes have heat-sensitive buttons and may take you to the fire.

_____ 6. If an elevator is operated by a fire warden or similar person, it should be safe to use.

_____ 7. It is not important to know where exits are since you can follow someone else.

REFERENCES

National Fire Protection Association. Code for Safety to Life from Fire in Buildings and Structures, NFPA 101-1976 (with 1981 approved changes).

National Fire Protection Association. Fire Protection Handbook, Fourteenth Edition. Boston.

National Fire Protection Association. Life Safety Code Handbook. Boston, 1973.

National Safety Council. Accident Prevention Manual for Industrial Operations. 7th ed., Chicago, 1978.

ANSWERS TO ACTIVITIES

ACTIVITY 1

1. Means of egress refers to the system of passages or paths that people take to get out of the building.
2. a. Hallway, stairwell, lobby (any one).
   b. Doorway, garage doors, fire exit (any one).
   c. Parking lot, porch, loading dock (any one).

ACTIVITY 2

1. True.
2. False.
3. False.
4. True.

ACTIVITY 3

1. Storage; loading or unloading; bicycle parking; temporary disposal of garbage.
2. Any four of the following:
   System was turned off; system was left unprotected when the building was painted; system was exposed to corrosive conditions; no water was available to system; water in system was frozen; there was mechanical damage to system; sprinkler heads were too old.

ACTIVITY 4

Checks beside 1, 2, 4, 5, 6, 7, and 8.

ACTIVITY 5

1. True.
2. False.
3. False.
4. True.

ACTIVITY 6

Any four of the following:
Evacuation routes, emergency duties, essential plant operations, medical and rescue duties, refuge areas, evacuation wardens, handicapped workers, coordination of plans with other businesses in the same building.

ACTIVITY 7

1. Any two of the following:
   Flashing lights; buddy system; tactile alarm.
2. A key-operated elevator that can by-pass floors involved in a fire.
3. Should.

ACTIVITY 8

1. False.
2. True.
3. True.
4. False.
5. True.
6. True.
7. False.